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Journal Correspondence

Dr. Amit Chattopadhyay
Editor in Chief
Director, SCASI
8603 Watershed Ct.
Gaithersburg, MD 20877
ac@sharmilachatterjee.com

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Oral Health Literacy of Parents of Pre-schoolers in New Zealand

Arthi Veerasamy,[1] Raymond Clarence Kirk.[2]

[1,2] School of Health sciences, University of Canterbury, Christchurch, New Zealand.

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Corresponding Author: Arthi Veerasamy email: arthisen3@gmail.com

ABSTRACT

Background. The aim of this project was to find the level of oral health literacy of parents of pre-school age children regarding their child's oral health. The primary objective was to improve the oral health status of pre-schoolers and to prevent early childhood caries.

Methods. 117 participants (parents of pre-schoolers) completed a self-administered oral health literacy questionnaire. Data obtained from the study was analysed using a statistical package (SPSS). Firstly, descriptive analysis was undertaken generating tables and graphs of socio-demographic variables. Later, associations between oral health literacy and socio-demographic variables were identified and also the relationship between parents' oral health literacy and their attitude towards water fluoridation in Christchurch was identified using bivariate and multivariable regression analysis. Psychometric analysis was generated to test the validity and reliability of the oral health literacy questionnaire.

Results. In the total sample, 38% of participants had poor oral health literacy regarding their child's oral health. The results also indicated that there were associations present between parents' oral health literacy and socio-demographic variables such as ethnicity, education and family income in the regression analysis ($F = 4.928$, $df = 21$, $p < 0.001$, with $R^2 = 0.521$). Nearly half of the parents opted for water fluoridation in Christchurch. A strong association between parents' oral health literacy and their attitude towards water fluoridation was identified ($t = 3.021$,$df = 91.101$;$p < 0.004$). Reliability was good for the developed oral health literacy instrument (Cronbach's alpha = 0.691).

Conclusions. This study of parents' oral health literacy in Christchurch, New Zealand identified the association of oral health literacy and socio-demographic variables which gives future guidance to improving the oral health status of New Zealand children. The relationship between parents' oral health literacy and their attitude towards water fluoridation was shown in this study.

Keywords: .Oral health literacy, child's oral health, water fluoridation, early childhood caries, oral health.

Health literacy is a non-pharmacological method of managing and preventing diseases. Basic health knowledge is needed in order to have a healthy life. In 1974, the term health literacy was first used in the discussion of health education as a policy issue affecting the health system (1). Hence, the problems associated with health literacy have been recognised for at least 30 years (2). Overwhelming developments in information technology and rapid advances in medical scientific knowledge demand that the public obtain an ever-increasing understanding of diseases for good decision- making and self-management of diseases. Recent studies have identified health literacy as not only reading and understanding health related materials, but also having the basic health knowledge to prevent diseases, self -manage chronic conditions and to participate in health care decision making(3, 4).

In New Zealand, little work has focused on health literacy (5). The New Zealand Health Strategy recognises the role of health literacy in the health of the individual and in the community (6). According to the results from the 2006 Adult Literacy and Life Skill Survey, New Zealanders on average have poor health literacy skills, with both Maori and Non Maori males and females scoring an average of less than 275, which is the minimum required score for individuals to meet the complex demands of everyday life and work in a knowledge -based economy (5). In this survey, 190 health related questions were asked to test the knowledge on five different components of health literacy namely health promotion (60 items), health protection (64 items), disease prevention (18 items), health care maintenance (16 items) and system navigation (32 items); and scored between 1 and 500.

The concept of health literacy applies to all aspects of health, including oral health. Early childhood caries is a new phenomenon that has emerged as a significant health issue for children younger than 5 years of age (7). The children who have early childhood caries are much more likely to develop further dental problems, including gingivitis and periodontal disease as they age (8). Children with cavities have more oral infections and difficulties, resulting in issues with eating and nutrition (8).

Proper oral hygiene practices started from birth will prevent early childhood caries and are therefore to be encouraged among the parents. Parents with low oral health literacy are expected to have less knowledge about children's oral health and are more likely to follow unhealthy behaviours and attitudes which possibly affect children's health (9).

Many past studies have supported the importance of parental health literacy in a child's health outcome (10, 11).

The development of the permanent first molar is initiated in the 4th month of intra-uterine life (12) and teeth need to last for the child's lifetime. Hence, the intervention to prevent oral diseases should be started even before the birth of the child, as it is the mother's responsibility to protect the child's teeth. The parents should know the proper nursing care to prevent early childhood caries and are expected to know the effects of sweet drinks, sub-optimal diet and poor brushing habits on the child's oral health, as well as the importance of fluoride in preventing caries and the proper usage of fluoride toothpaste. The parents are responsible for preventing decay and caring for children's oral health in the preadolescent period, especially the preschool period; hence parents should have good knowledge about preventing early childhood caries and protecting the child's oral health system.

Canterbury has the second largest population in New Zealand with a significant indigenous and immigrant population. Compared to all major metropolitan/urban areas in New Zealand, the Canterbury region is the least water fluoridated area (13). Christchurch is the only major city without water fluoridation in New Zealand (14). In water fluoridated areas of New Zealand, the decay rates were 30 percent lower among five year olds and 40 percent lower among 12 year olds (13). Christchurch four year-olds have on average 95 percent more decay in their baby teeth than children from Wellington of the same age (15). Christchurch nine year olds have on average 80 percent more decay in their permanent teeth than Wellington nine year olds (16). As in other parts of the world, water fluoridation is a controversial subject in New Zealand (16). In New Zealand, water fluoridation is endorsed by the Ministry of Health but rejected by some communities and organisations such as the Fluoride Action Network (16). Owing to the pressure from anti-fluoridation campaigners, fluoridation was stopped in some areas Canterbury region, including Ashburton in 2002 and Timaru in 1985. A dental health survey in October 2000 showed 60 percent of Christchurch citizens did not support water fluoridation.

An Australian study investigated the associations between oral health literacy and oral health related outcomes in an indigenous population. This research confirmed that people with poor oral health literacy had poorer oral health knowledge and engaged in more harmful oral health-related behaviours(17). The results also suggested that poor oral health literacy was a risk indicator for self-reported oral health(17). Indigenous children had poor dental health outcomes associated with a higher level of untreated dental caries and less preventive therapies compared to non-indigenous Australian children. The instrument used in this study to determine oral health literacy was REALD-30, which was a validated word recognition instrument developed by Lee et, al. using a list of 30 commonly used terms and words in written materials and brochures usually provided to dental patients (18).

In North Carolina, a cross-sectional survey was conducted to determine the relationship between caregiver's oral health literacy and children's oral health outcome (9). The study was conducted in 106 children by conducting a complete oral examination accompanied with measures of oral health knowledge and oral health behaviour of caregivers separately. Oral health knowledge was measured using the REALD-30 instrument. An association was observed between oral health literacy and oral health status but the results were not statistically significant in the bivariate analysis. Parents of children with high treatment needs had a lower REALD-30 score compared to parents of children who required lower and moderate treatment needs (9).

No data exists regarding oral health literacy among New Zealand parents, creating a gap in the research and knowledge base that this study addresses. The aim of the current study was to identify the existing level of oral health literacy among New Zealand parents and to investigate the relationship between parents' attitude towards water fluoridation and their oral health literacy.

METHODS

The participants of this study were the parents or caregivers of children enrolled in pre-schools in Christchurch city. A cross sectional quantitative study was conducted between 15th August 2010 and 15th September 2010 and we selected a convenient sample of five pre-schools for our study. Two of them were located outside the University of Canterbury campus (ABC Early Learning Centre and Annabel's Early Learning Centre). The other three were located inside the University of Canterbury campus (Ilam Early Learning Centre, Montana Early Learning Centre and Early Years Care and Education).

Provision of health information, general literacy and the ability to access health care information are required to improve health knowledge. Basic health knowledge can increase the interest in receiving health information. At the same time, interest in acquiring health information is expected to in-

crease health knowledge which will help an individual to participate in shared- decision making and self-management of diseases. Hence, a person with high health knowledge will possibly have high health literacy. Therefore, the parents' oral health knowledge on oral health promotion, oral health protection, oral health care maintenance, disease prevention and service navigation were measured.

According to the current study, parents who have high oral health literacy had the following knowledge and ability regarding their child's oral health:

- Oral health promotion (controlling the spread of microorganisms and healthy behaviours);
- Oral health protection (knowledge of the usage of topical fluoride and water fluoridation);
- Disease prevention (preventing dental caries and managing teething);
- Health care maintenance (comprehension skill);
- System navigation (understanding the available free dental services and knowledge about the first dental visit).

The study questionnaire was based on an earlier survey developed by Ludke et al.(19) which had three sections and one section was removed to develop a shorter version. Three questions regarding topical and water fluoridation, and four questions regarding teething were added to the original questionnaire. The questionnaire developed with above changes was tested for validity and reliability.

The survey was a self-administered written questionnaire and consisted of 3 sections and 33 questions. The questionnaire has been designed to be used only among parents of pre-schoolers.

Section one was designed to measure the oral health knowledge on different components of oral health literacy in parents. The questions tested the parents' basic dental knowledge (5 items), Oral health promotion (3 items), Oral health protection (3 items), Disease prevention (7 items), and System navigation (one item). Most of the questions were about early childhood caries (ECC) because ECC is considered to be the major oral health problem among pre-schoolers.

Example

1. A cavity is:
   a. A silver filling in a tooth
   b. A small hole in a tooth
   c. Sticky coating on the tooth
   d. Don't know
2. To manage pain due to teething:
   a. Allow nursing or bottle feeding at night
   b. Rub the gum
   c. Allow child to bite chilled object
   d. Don't know

Section two was based on Ludke et al.(19) questionnaire and was added to test the health care maintenance component of oral health literacy (5 items) by measuring parents' comprehensive skills. In this section, a paragraph was given about the instructions given to a parent after child's fluoride treatment and five true or false questions were asked to test participant's understanding.

Section 3 contained demographic data to compare the parents' health literacy level with socio-demographic parameters such as age, sex, relationship to child, ethnicity, employment, highest level of education and family income. This part of the questionnaire was modified according to the New Zealand population for ethnicity question and also the questions about employment and family income were added. An average of five minutes was required to complete all three sections of the questionnaire.

The parents were invited to participate in the survey using various methods. Invitations were included in newsletters, sent via e-mails or just posted on school notice-boards. Parents or care givers were eligible to participate, if they had children aged five years or below under their care. The 380 questionnaires were distributed to all the parents of children enrolled in the pre-schools. The parents were requested to fill in the questionnaire. The "Dental Health Survey" drop box was kept near the register by the preschool entrance from the 15th of August until the 15th of September 2010 for the return of completed questionnaires.

Every parent received a survey package which contained an information sheet, the questionnaire, a consent form and an envelope. Approximately 380 parents/guardians of children 0-5 years of age received the survey package and were requested to complete the oral health literacy assessment instrument. The parents/ guardians were informed of the end date of the survey. By the 15th of September, 117 completed questionnaires and signed consent forms were collected from the pre-schools. Confidentiality was maintained throughout the study as the names of parents were not collected and a system of code numbers was used instead. Statistical Package for the Social Sciences (SPSS-18)® was used for analysing the data obtained in this study.

The data were pre-processed to insure a quality check before running the analysis. This involved verifying any "missing data" and "outliers". Four

incomplete questionnaires were found and they were missing the answer for the question "gross weekly income". These questionnaires were included in the data analysis procedures and grouped under participants who selected the option "don't know" for the question "gross weekly income".

Calculation of Scores

Sections one and two were scored 1 for correct answer and scored 0 for the wrong answer. Except the question regarding fluoridating Christchurch's water supply, all other questions about topical and water fluoridation in the section one and two were included in calculating the total oral health literacy score. For the categorical analysis, we used tertiles to divide the total oral health literacy scores (1-23) into three ordered distributions based on past studies. These categories were used only for categorical analysis (cross-tabulation) and for further analysis, such as t-test and regression analysis; the raw health literacy scores were used. Three categories were formed from the total score, namely Poor (1-16), Moderate (17-19) and Good (20-23).

Multiple linear regression analysis was undertaken by creating dummy variables for all the socio -demographic variables. The raw oral health literacy scores (1-23) were used for the regression analysis and the dependent variable was measured in continuous-interval scale. Two models were developed for the regression analysis. In the first model, the oral health literacy (dependent variable) was regressed with socio-demographic variables and, in the second model; parents' attitudes towards water fluoridation were added to the first model.

Ethical Considerations

Ethics approval was obtained from the University of Canterbury Human Ethics Committee and an outline of the study was provided to all participants in the survey. A consent form with study information including the researcher's contact details was given to each participant in case of the need for clarification or support at any stage of the study.

RESULTS

Validity and Reliability

The oral health literacy instrument developed by Ludke et al. (2010) was tested for validity and psychometric testing was carried out for the original questionnaire. As the original questionnaire was modified to develop a shorter version and 7 questions regarding fluoridation and teething were also added to the original questionnaire, a pilot test was performed for the developed questionnaire among the parents of pre-schoolers to test the acceptance of the questionnaire by involving Maori, European New Zealanders and immigrant parents. Few parents indicated that they were unsure of the word pacifier and later in the final survey word "dummy" was added in parenthesis to make it clear.

Internal Consistency

The internal consistency of the questionnaire was tested using Cronbach's alpha (0.691). The Spearman- Brown stepped up reliability coefficient was calculated separately for two sections of the questionnaire and also for the total questionnaire. The different values of the Spearman-Brown coefficient for sets (Q1-Q19, Q20-Q24 and Q1-Q24) showed the dissimilarity of variances among items in the sets.

Unidimensionality

The unidimensionality was tested using inter-item correlations and corrected item-total correlations. The test was performed individually for the knowledge test and the comprehension test by creating a correlation matrix for all the questions in each set. Inter-item correlation was performed for the actual responses given by the parents before correcting the questions into correct and incorrect responses. Complete analysis of the correlation matrix indicated that no item in the questionnaire had a correlation < 0.15 on correlating with other items in the questionnaire, which suggests that the questionnaire has unidimensionality.

Corrected item- total correlation was measured by dichotomizing the responses into either a correct or wrong answer. The psychometric analysis of corrected item-total correlation was performed to check how well a question differentiates between participants who know the material and those who do not. After correcting the answers, the values of discrimination found between all questions were ≥ 0.40 which represents a good discrimination between all questions.

Sample Characteristics

Table 1 describes the socio-demographic details of the study sample. In the total sample, around 2/3 of the participants were between 30-39 years of age. The majority of the participants were female (79.5%). Sixty one percent of participants had a university education, the highest obtained education level, and 35% had high school education or below.

The majority of participants (65%) identified as New Zealand European. The calculated health literacy scores (see Table 2) indicated that the highest number of participants (41.0%) were categorised as having a moderate health literacy score. In the total

Table 1. Socio-demographic variables of the total sample.

Variables	Count	Percentage
Age in Years		
Less than 30	24	20.5
30-39	67	57.3
40-49	23	19.7
Greater than 50	3	2.6
Gender		
Men	24	20.5
Women	93	79.5
Education		
High school or lower	41	35.1
University education	71	60.7
Employment		
Working in Health	9	7.7
Working in Education	20	17.1
Working in Other Sectors	72	61.5
Unemployed	16	13.7
Relationship with child		
Mother	89	76.1
Father	24	20.5
Family income per week		
Less than 500	19	16.2
500-1000	38	32.5
1000-1500	26	22.2
>1500	24	20.5

Table 2. Frequency of oral health literacy scores in three categories.

Health Literacy	Modified score	Count	Percent
Poor	1-16	44	37.6
Moderate	17-19	48	41.0
Good	20-23	25	21.4

population, 37.6% and 21.4% of participants were categorised as having poor and good oral health literacy respectively. The raw health literacy scores were normally distributed, having a slight negative skew, a median of 17, a mean of 16.85 and a standard deviation of 3.14.

In the total sample, 43.6% of participants responded as not wanting Christchurch's water supply fluoridated and 56.4% of participants stated that it should be fluoridated. On the question regarding the effect of fluoride, 73.5% of participants believed that fluoride in the water prevents dental decay and 7.7% of participants felt that fluoride in the water causes systemic diseases. In the total sample, 16.2% of participants admitted that they did not know the answer on the effect of fluoride in water. In the total sample, 40% of parents were not aware of the need for the first dental visit before school age.

Bivariate Analysis

The results of the t-test (Table 3) show that parents' attitudes towards Christchurch's water fluoridation and raw health literacy scores were associated and the result was statistically significant (t=2.951, df =91.101; p = .004).

Table 3. T-test for health literacy and parents' attitude towards water fluoridation.

Water Fluoridation	N	Mean	SD
Yes	66	17.61	2.648
No	51	15.88	3.426
Equal Variance Not assumed test t= 2.951; df= 91.101;p < 0 .004			

A single way cross tabulation (Table 4) between modified health literacy and socio-demographic factors gives the nominal level data under different categories of age; gender; education level; ethnicity; employment; relationship with the child, and gross family income. The chi-square values for income (χ^2= 26.841, P=0.001), ethnicity (χ^2= 21.706, p=0.017) and education (χ^2= 14.386, p=.026) were high and statistically significant, which indicates the extreme association of health literacy with education, income and ethnicity.

Multivariable Analysis

Table 5 illustrates the regression results for model I and model II. Model one was developed using socio-demographic variables as predictors and oral health literacy as the dependent variable. This returned a statistically significant model (F =4.928; df =21; p< 0.001), with R^2 = 0.521. In this model, significant results were obtained for male (β= -2.36; SE=1.09; p<0.05), New Zealand European (β= 1.57;SE=0.59; p<0.01), Indian (β= -4.22; SE=1.40; p<0.05), Samoan (β= -3.14; SE1.29; p<0.05), employment in education sector (β= -1.67; SE=0.72; p<0.05), and income less than $500 (β= -3.56; SE=1.06; p<.001).

The second model (F =5.200; df=22; p<0.001) was developed by including parents' attitudes towards water fluoridation in the first model which rendered the effect of gender (male) as no longer significant and raised the coefficient of determination to 0.549. In the second model, income group $500-$1000 per week (β= -2.04; SE=0.94; p<0.05)

Table 4. Cross tabulation between oral health literacy and socio-demographic variables.

Socio-Demographic	Poor		Moderate		Good		Chi-square(p)	
	N	%	N	%	N	%	χ^2	p
Age in years							11.949	0.063
Less than 30	13	54.2	7	29.2	4	16.7		
30-39 years	23	34.3	25	37.3	19	28.4		
40 and above	8	34.2	16	56.5	2	8.7		
Gender							3.549	0 .170
Female	31	33.3	41	44.1	21	22.6		
Male	13	54.2	7	29.2	4	16.7		
Education							**14.386 ***	**0 .026**
University	21	29.6	35	49.3	15	21.1		
High School	22	55.0	9	22.5	9	22.5		
Other	1	20.0	4	60.0	1	20.0		
Ethnicity							**21.706 ***	**0.017**
NZ European	21	27.6	35	46.1	20	26.3		
Chinese	0	-	1	100.0	0	-		
Maori	3	60.0	2	40.1	0	-		
Samoan	5	100.0	0	-	0	-		
Indian	4	100.0	0	-	0	-		
Other	11	42.3	10	38.5	5	19.2		
Employment							3.109	0.795
Working in health	5	31.3	7	43.8	4	25.0		
In education	10	47.6	8	38.1	3	14.3		
Other sectors	21	32.8	28	43.8	15	23.4		
Unemployment	8	50.0	5	31.3	3	18.8		
Relationship							7.439	0.490
Mother	29	32.6	39	43.8	21	23.6		
Father	13	54.2	7	29.2	4	16.7		
others	2	50.0	2	50.0	0	-		
Family Income							**26.841 ***	**0.001**
Less than 500	15	32.6	4	21.1	0	-		
500-1000	17	38.6	15	39.5	6	15.8		
1000-1500	7	26.9	11	42.3	8	30.8		
>1500	2	8.3	14	58.3	8	33.3		
Don't know	3	30.0	4	40.0	3	30.0		

***** Statistically significant χ^2 results.

Table 5. Table 5. Multiple linear regression results.

Predictor Variables	Model I		Model II	
	β	**SE**	**β**	**SE**
Age in years				
Less than 30	1.42	0.84	1.57	0.83
30-39 years	0.44	0.64	0.73	0.64
40 and above	*Reference*	*Category*		
Gender				
Female	*Reference*	*Category*		
Male	**-2.36***	1.09	-1.09	1.08
Education				
University	1.26	1.08	1.13	1.05
High School	-0.26	1.09	-0.22	1.06
Other	*Reference*	*Category*		
Ethnicity				
NZ European	**1.57****	0.59	**1.90***	0.59
Chinese	4.20	2.54	3.91	2.48
Maori	-0.47	1.21	-0.20	1.19
Samoan	-3.14	1.29	**-2.45***	1.29
Indian	-4.22	1.40	**-3.31***	1.42
Other	*Reference*	*Category*		
Employment				
Working in health	0.15	0.85	0.38	0.83
In education	**-1.67***	0.72	-1.49	0.71
Other sectors	*Reference*	*Category*		
Unemployment	-0.46	0.73	-0.14	0.73
Relationship				
Mother	1.11	2.69	0.62	2.63
Father	2.69	2.90	1.97	2.85
Child's step father	0.92	3.08	0.55	3.01
Child's foster parent	-0.55	3.74	-1.40	3.66
Grand parents	*Reference*	*Category*		
Family Income				
Less than 500	**-3.56*****	1.06	**-3.84*****	1.05
500-1000	-1.89	0.96	**-2.04***	0.94
1000-1500	-0.28	1.00	-0.45	0.97
>1500	-0.04	1.04	-0.07	1.01
Don't know	*Reference*	*Category*		
Water Fluoridation	-	-	**-1.19***	0.49

Model: I forcing socio-demographic variables
Model: II adding attitude towards water fluoridation in Model 1
β, regression coefficient: SE, Standard error, * Significant at P < 0.05, ** Significant at P <0.01, ***Significant at P <0.001

and parents' attitude towards water fluoridation (β= -1.19; SE 0.49; $p<0.05$) were also significant.

DISCUSSION

The key objective of this study was to measure the oral health literacy among the parents in Christchurch by measuring the oral health knowledge and comprehension skill of the parents. The female participants and New Zealand European ethnic group were highly represented in the current study. In the total population, highest number of participants (41.0%) had moderate level of oral health literacy and 37.6% and 21.4% of participants were recognized as having poor and good oral health literacy respectively.

Bivariate analysis of the oral health literacy score with socio-demographic variables indicated that income, education, ethnicity and gender were highest determinant of oral health literacy. Later, these results were confirmed in the regression analysis. The regression analysis suggested that European New Zealanders had higher oral health literacy and those with Samoan and Indian ethnic background had poor oral health literacy than Maori and other Ethnic groups. The significant regression coefficient for some of the categories among income and ethnic groups suggested that families with income less than $500/ week had poor oral health literacy compared to others. The regression analysis also suggested that parents working in education sector and other than sectors had poor oral health literacy but the results were significant only for parents working in education sector which is not an anticipated result in the current study. In the total sample, there was only one parent correspond to Chinese ethnicity even though Chinese are the major immigrant population in Christchurch in which 81% of them where aged between 15 and 60 and majority of them live in the area where recruitment taken place (20). The under-representation of the Chinese ethnic group in the study needs a further investigation.

More than a half of parents opted for water fluoridation in Christchurch city. The parents who had poor oral health literacy scores reported that they do not want fluoridation in Christchurch. This association was confirmed in T-test, in which parents who admitted that they want water fluoridation in Christchurch scored high on oral health literacy with the T-test results being statistically significant. The regression analysis indicated that parents who do not want water fluoridation also lack oral health literacy and they are mainly from an ethnic background other than European New Zealanders and families with income less than $1000.

In New Zealand only 22% of the population completed tertiary education (21) compared to 61% in the current study, this is not surprising as some of the early childhood centres involved in the study were associated with the university. The majority of participants were in the age group 30-39, given the sample was drawn from parents with pre-school aged children. The previous studies involving parents of children show, a participation rate of a significantly higher proportion of females compared to males (22, 23) and this routine was again confirmed in this study since 80% of study participants were female.

Although very little research has been undertaken in oral health literacy with which to compare our results, several findings related to oral health literacy were confirmed in the current study. The results of Adult health Literacy Survey (24) indicated that ethnicity, education and income as important predictors of oral health literacy. The current study indicated that the income and the ethnicity as the important predictors by finding significant regression coefficient for some of the categories among income and ethnic groups. The association between education and oral health literacy was confirmed in bivariate analysis but not in regression analysis. The Adult health literacy survey(24) indicated that compared to European New Zealanders and other ethnic groups, Maori, Pacifica and Asians were low performers in adult literacy skills. In the current study, except for European New Zealander, all other ethnic groups had a poor oral health literacy which was indicated by a negative regression coefficient values in the regression model.

Study Limitations

A convenient sample of pre-schools was selected (two schools on the University campus) for this study which resulted in an over-representation of participants with tertiary qualifications compared to the wider community. If pre-schools were selected from a wider socio-economic cross-section of the community then it is expected that the reported results would have been strengthened. Hence, in future studies sample selection criteria should use randomisation of preschools to avoid this bias.

The low response rate in the current study potentially limits our understanding of oral health literacy across ethnic groups in New Zealand. The questionnaire was distributed to all parents of children attending the selected pre-schools and it's possible that parents with higher oral health literacy were over-represented in the study sample. Hence parents with low oral health literacy may have not responded to the study invitation and study results

were biased by over-representation of parents with high oral health literacy. If more participants with low oral health literacy had participated in the study, it would have strengthened the reported results. Thus, the combined effect of response rate and selection bias has diluted the reported results.

Information bias was another issue in this study as the participants were not blinded to the study aims.

Our study results would be enhanced if parents' oral health literacy was compared with children's oral health status. Because of the cost of funding, a children's oral health examination was not undertaken as part of this study. An important consideration, however, for a study would be secure funding so that oral health literacy and children's oral health status or DMFT rate could be compared. The association between parents' level of oral health literacy and children's oral health status can then be identified which would help policymakers and providers to understand the reflection of a lack of parents' oral health literacy on a child's oral health.

Implications and Policy Recommendation

The oral health literacy interventions could be targeted more towards Maori and the immigrant population. It would be ideal if government policies concentrated more on these ethnic minority groups especially immigrant population from developing countries to improve their oral health literacy and thus their oral health outcomes.

This study evoked that oral health literacy seems to be low even among parents working in the education sector. The reason behind this result needed a further investigation in future studies. The reason behind this result should be investigated further in future studies. Also this result suggests that health care providers could avoid using traditional methods of using education and employment as predictors of oral health literacy. Rather than assuming preconceived levels of oral health literacy, health care providers should understand the parents' level of oral health literacy by measuring it or by interacting with parents.

The significant association identified between parents' attitude towards water fluoridation and oral health literacy suggest that, more than convincing people to vote "yes" for water fluoridation, a more targeted approach that increases oral health knowledge regarding preventing dental caries and protecting teeth against oral cavities will, potentially result in positive outcomes regarding fluoridating the communities in New Zealand.

In the current New Zealand heath system, oral health advice is given mostly by oral health providers and Plunket nurses. Oral health information provided repeatedly by different health care providers may possibly improve parents' awareness of oral health issues and, in turn, oral health literacy. Therefore, if the child's primary health care provider gives priority to children's oral health by educating the parents; this may improve the parents' oral health literacy which will then be reflected in the oral health status of the children. It is important that parents are educated on the link between oral health and general health, by combining the general and oral health services.

Improving parents' knowledge on oral health issues would improve the oral health literacy of parents which will reduce oral health diseases in children and improve oral health outcomes.

Most of the parents in the current study were not aware that the first dental visit should be made before the first year and reported that the child should first see a dentist only at school age. Information about the Government's free dental services advertised on national television (as is the case for cervical screening) to improve the awareness of free dental services, would be very effective in informing the parents of this policy.

Important simple oral health tips or information about free oral health services printed on children's toothpastes, toothbrushes and children's food and drink packaging may also increase parents' exposure to, and therefore understanding of oral health issues.

In recent years the media is considered to be one of the best approaches for reaching people. Radio, television and the Internet are considered to be the best media to engage public attention. On New Zealand television, many health programs and dramas have been telecast which have improved the public's health literacy. Hence, a media focus on oral health could be an effective way of increasing parental awareness on it.

Oral health education could be included in high school subjects as an early intervention to improve children's knowledge about oral health which would help them to improve their own oral health as well as that of their children in the future.

Medical and dental institutes should train students to know the parents' ability to understand health care information and to improve their knowledge based on their ability. They could also be trained to involve parents in health care decision making by informed choices. This would possibly improve parents' involvement and interest in health issues which potentially improve oral health literacy.

Future Directions

Future research could concentrate on:

- The effect of early intervention well before pregnancy in improving mothers' oral health literacy regarding the child's oral health.
- The effect of motivational interviewing in improving oral health literacy.
- Identifying the health care providers' perspective on oral health literacy.
- Identifying the current level of awareness among health care providers about improving parents' oral health literacy.

CONCLUSION

This study of parents' oral health literacy in Christchurch, New Zealand identified the association of oral health literacy and socio-demographic variables which gives future guidance to improving the oral health status of New Zealand children. The relationship between parents' oral health literacy and their attitude towards water fluoridation was shown in this study.

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